

## CLAIMS:

1. A method of determining traffic paths between one or more source-destination node pairs in a communications network, comprising  
5 starting from a first set of paths between said source-destination node pairs, determining a second set of paths between said source-destination node pairs while taking into account a set of constraints, such that said second set of paths emulates said first set of paths.
- 10 2. A method according to claim 1, wherein the second set of paths is determined such that the traffic load on said second set of paths emulates the traffic load on said first set of paths.
- 15 3. A method according to claim 1 or 2, wherein the first set of paths are included in a routing and load model for said source-destination node pairs related to a first routing protocol.
- 20 4. A method according to claim 3, wherein said routing and load model takes into account the network topology, the route configuration resulting from the use of the first routing protocol and/or a selection of source-destination node pairs.

5. A method according to any preceding claim, where the first set of paths is related to the use of a first routing protocol.

6. A method according to any preceding claim, where the second  
5 set of paths is determined for use with a second routing protocol.

7. A method according to any preceding claim, wherein the second set of paths is determined such that the routing using a second routing protocol is similar to the routing using a first routing protocol

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8. A method according to any preceding claim, wherein said set of constraints is related to the second set of paths.

9. A method according to any preceding claim, wherein said  
15 constraints result from network nodes limitations and/or routing protocol constraints related to said second set of paths.

10. A method according to any of claims 4 to 9, wherein said first routing protocol includes an interior gateway protocol.

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11. A method according to any of claims 4 to 10, wherein said first and/or said second routing protocol applies load balancing.

12. A method according to any of claims 4 to 11, wherein said first routing protocol includes an equal cost multiple paths extension.

13. A method according to any of claims 5 to 10, wherein in said  
5 second routing protocol data are routed on pre-determined paths.

14. A method according to any of claims 5 to 11, wherein said second routing protocol includes a multi-protocol label-switching traffic engineering protocol.

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15. A method according to any preceding claim, wherein said constraints comprise a maximum number of paths between each source-destination node pair.

16. A method according to any preceding claim, wherein said  
15 constraints comprise that the traffic between a particular source-destinations node pair is load-balanced such that the share of traffic along any paths is a fraction with constrained integer numerator and denominator.

17. A method according to any preceding claim, wherein a search  
20 technique is used to determine said second set of paths.

18. A method according to any preceding claim, wherein one of the following search techniques are used to determined said second set of paths: "generate and test" search algorithm, constraint programming and/or mathematical programming.

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19. A method according to any preceding claim, wherein an optimal search algorithm is used.

20. A method according to any of claims 1 to 18, wherein a heuristic search algorithm is used.

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21. A method according to any preceding claim, wherein each source-destination node pair is treated independently.

22. A method according to claim 21, comprising a method of avoiding a systematic bias for particular paths.

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23. A method according to claim 22, wherein ties between symmetric solutions are broken randomly.

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24. A method of calculating traffic paths between one or more source-destination node pairs in a communications network, comprising

starting from a first set of paths between said source-destination node pairs, determining a second set of paths between said source-destination node pairs while taking into account a set of constraints, such that

- i) said second set of paths is similar to the first set of paths; and
- 5 ii) the traffic load of said second set of paths is similar to the traffic load of said first set of paths.

25. A method of calculating traffic paths between one or more source-destination node pairs in a communications network, comprising

- 10 starting from a first set of paths between said source-destination node pairs determined using a first routing protocol, determining a second set of paths between said source-destination node pairs for use with a second routing protocol, such that the load balancing in said first and second routing protocols is similar.

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26. A method of operating a communications network, comprising switching at least some network traffic from a first routing protocol to a second routing protocol, wherein the method includes a method of calculating traffic paths according to any of claims 1 to 25.

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27. A method of measuring traffic between a plurality of source and destination nodes in a communications network comprising the method according to any of claims 1 to 26.

28. A method according to claim 26 or 27, wherein at least some of the traffic is protected using secondary tunnels.

5 29. A method of providing secondary paths for a communications network, comprising the method of any of claims 1 to 26.

30. A method according to claim 29, wherein a measured maximum link load is used as the primary bandwidth for each link.

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31. A method according to claim 29 or 30, wherein part of the remaining link capacity is used for the secondary paths.

32. A method according to claim 29, 30 or 31, wherein the secondary paths are determined for the non-load balanced case.

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33. A method of routing traffic between nodes in a communications network, the method comprising routing the traffic from a source node to a destination node using a first routing protocol while mimicking a second routing protocol.

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34. The method according to claim 33, wherein the first routing protocol is the MPLS-TE protocol, and the second protocol is the ECMP protocol.

5           35. The method according to claim 34, comprising:  
            associating each of a plurality of source-destination pairs with more  
            than one traffic path; and  
            splitting the traffic between a given source-destination pair between  
            the more than one traffic paths associated with the given source-destination  
10           pair, thereby to perform load balancing.

            36. The method according to claim 33, comprising:  
            operating a distributed protocol on said nodes, the distributed protocol  
            being adapted to automatically manage the creation of paths.

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            37. The method according to claim 36, wherein the distributed  
            protocol is adapted to provide for the creation of load-balancing paths.

            38. An apparatus according to claim 36 or 37, wherein the  
20           distributed protocol is adapted to provide for automeshing.

39. The method according to any of claims 36 to 38, comprising issuing to each node an instruction indicating that the paths whose creation is managed automatically by said distributed protocol are to mimic IGP paths.

5 40. The method according to claim 39, wherein said instruction is learned over said distributed protocol from the node which is to become the destination of the paths.

10 41. An apparatus for calculating paths in a communications network, adapted to perform the method of any preceding claim.

42. An apparatus according to claim 41, wherein said apparatus includes one or more nodes of said communications network.

15 43. An apparatus according to claim 42, wherein said one or more nodes update the calculation of traffic paths after a change in the network topology.

20 44. An apparatus according to claim 43, wherein a time lag is introduced between the change in the network topology and an update of the traffic paths.



45. A network management system for managing a network, adapted to perform the method of any of claims 1 to 40.

46. A computer program for performing the method of any of  
5 claims 1 to 40 when operated in a computer system.

47. A method of calculating paths in a communication network as described herein with reference to the accompanying drawings.